विद्या सर्वार्थि साधिका

ANANDALAYA

PERIODIC TEST – 2

Class: XI

Subject: Mathematics (041) M.M: 80

Date: 18-09-2025 Time: 3 Hours

General Instructions:

1. This Question Paper has 5 Sections A, B, C, D and E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 4 questions carrying 05 Marks each.
6. Section E has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1,1 and 2 marks in 2 questions and 2, 2 marks in 1 question.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 3 Qs of 3 Marks and 2 Questions of 2 marks has been Provided. An internal choice has been provided in 2 Qs of 2 marks questions of section E.
8. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required if not stated.

SECTION- A

1. If X = $\{8^n - 7n - 1 / n \in N\}$ and Y = $\{49n - 49 / n \in N\}$, then_____. (1)
   (A) $X \subset Y$ (B) $Y \subset X$ (C) $X = Y$ (D) $X \cap Y = \emptyset$

2. Find the number of terms in the expansions of $(1 - 2x + x^2)^7$. (1)
   (A) 7 (B) 14 (C) 15 (D) 8

3. For any integer k, $-i^{4k+3}$ is_____. (1)
   (A) 0 (B) 1 (C) i (D) $-i$

4. Given that x, y and b are real numbers and $x < y$, b < 0, then_____. (1)
   (A) $x/b < y/b$ (B) $x/b \leq y/b$
   (C) $x/b > y/b$ (D) $x/b \geq y/b$

5. If the sets A and B are given by $A = \{1, 2, 3, 4\}, B = \{2, 4, 6, 8, 10\}$ and the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$, then_____. (1)
   (A) $(A \cup B)' = \{5, 7, 9\}$ (B) $(A \cap B)' = \{1, 3, 5, 6, 7\}$
   (C) $(A \cap B)' = \{1, 3, 5, 6, 7, 8\}$ (D) None of these

6. The minimum value of the expression $3^x + 3^{1-x}$, x ∈ R, is_____. (1)
   (A) 0 (B) $\frac{1}{3}$ (C) 3 (D) $2\sqrt{3}$

7. The conjugate of the complex number $\frac{1+i}{1-i} - \frac{1-i}{1+i}$ is_____. (1)
   (A) i (B) -i (C) 1 (D) -2i

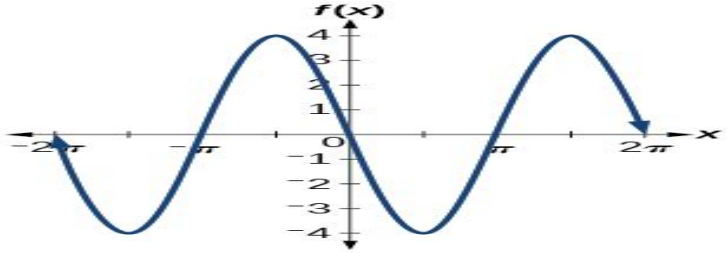
8. If ${}^nP_4 : {}^nP_5 = 1 : 2$ then find the value of n. (1)
   (A) 4 (B) 5 (C) 6 (D) 7

9. The multiplicative inverse of $\frac{3+5i}{4-3i}$ is equal to_____. (1)
   (A) $\frac{-3}{34} - \frac{29i}{34}$ (B) $\frac{3}{34} + \frac{29i}{34}$ (C) $\frac{3}{34} - \frac{29i}{34}$ (D) $\frac{-1}{34} - \frac{29i}{34}$

10. Everybody in a room shakes hands with everybody else. The total number of handshakes is 66. Find the total number of persons in the room. (1)
    (A) 11 (B) 12 (C) 13 (D) 14

11. 1.1^{10000} is_____1000. (1)
(A) Less than (B) Greater than (C) Equal to (D) None of these

12. Identify the name of the function whose graph is given below. (1)
(A) $-4\sin x$
(B) $-4\cos x$
(C) $\sin 4x$
(D) $\cos 4x$



13. The value of $tan\ 1°\ tan\ 2°\ tan\ 3°\ \ldots\ tan\ 89°$ is_____. (1)
(A) 0 (B) 1 (C) ½ (D) Not defined

14. If "a" is the first term and "r" is the common ratio, then the n^{th} term of a G.P is_____. (1)
(A) ar^n (B) ar^{n-1} (C) $(ar)^{n-1}$ (D) None of these

15. Find the value of ${}^5C_1 + {}^5C_2 + {}^5C_3 + {}^5C_4 + {}^5C_5$. (1)
(A) 30 (B) 31 (C) 32 (D) 33

16. If number of elements in set A is n, then the number of elements in Power set of A is_____. (1)
(A) n (B) 2n (C) 2^n (D) n^2

17. Let S be the sum; P be the product and R be the sum of the reciprocals of 3 terms of a G.P. then $P^2\ R^3 : S^3$ is equal to_____. (1)
(A) 1: 1 (B) (common ratio) ^{n}: 1
(C) (first term)^2: (common ratio)^2 (D) none of these

18. If x is a real number and $|x| < 3$, then_____. (1)
(A) $x \geq 3$ (B) $-3 < x < 3$
(C) $x \leq -3$ (D) $-3 \leq x \leq 3$

Questions 19 and 20, a statement of Assertion (A) and a statement of Reason (R) are given. Choose the correct answer out of the following choices.

(A) Both A and R are true and R is the correct explanation of A.
(B) Both A and R are true but R is not the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

19. (A) : The domain of the relation $R = \{(x+2, x+4): x \in N, x < 8\}\ is\ \{3,4,5,6,7,8,9\}$ (1)
(R) : The range of the relation $R = \{(x+2, x+4): x \in N, x < 8\}\ is\ \{1, 2, 3, 4, 5, 6, 7\}$.

20. (A) : cosec x is negative in third and fourth quadrants. (1)
(R) : cot x decreases from 0 to $-\infty$ in first quadrant and increases from 0 to ∞ in third quadrant.

SECTION- B

21. (a) Let A and B be sets. If $A \cap X = B \cap X = \emptyset$ and $A \cup X = B \cup X$ for some set X, show that $A = B$. (2)

OR

(b) Let A, B and C be the sets such that A ∪ B = A ∪ C and A ∩ B = A ∩ C. Show that B = C.

22. For any two complex numbers z_1 and z_2, show that: $Re(z_1 z_2) = Rez_1 . Rez_2 - Imz_1 . Imz_2$. (2)

23. Find the degree measure of the angle subtended at the centre of a circle of radius 100 cm by an arc of length 22 cm. (2)

24. For set A = {1, 2, 3, …,14}. Define a relation R from A to A by (2)
$R = \{(x, y): 3x - y = 0, x, y \in A\}$. Determine its range, domain, and codomain.

25. (a) A manufacturer has 600 litres of a 12% solution of acid. How many litres of a 30% acid solution must be added to it so that acid content in the resulting mixture will be more than 15% but less than 18%? (2)

OR

(b) The longest side of a triangle is 3 times the shortest side, and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm, find the minimum length of the shortest side.

SECTION- C

26. Find $(a + b)^4 - (a - b)^4$. Hence, evaluate $(\sqrt{3} + \sqrt{2})^4 - (\sqrt{3} - \sqrt{2})^4$. (3)

27. Solve for x, $\frac{|x+3|+3}{x+2} > 1$. (3)

28. A student has to answer 10 questions, choosing at least 4 from each of Part A and B. If there are 6 questions in Part A and 7 in Part B, in how many ways can the student choose 10 Questions. (3)

29. (a) Solve: (i) If $(3a - 6) + 2ib = -6b + (6 + a)i$ then find the real value of a and b. (3)

(ii) If $\left(\frac{1-i}{1+i}\right)^{100} = p + i\,q$ then find the value of p and q.

OR

(b) If α and β are different complex numbers with |β| = 1, then find $\left|\frac{\beta-\alpha}{1-\bar{\alpha}\beta}\right|$.

30. (a) Let R be a relation from Q to Q defined by $R = \{(a, b): a, b \in Q \text{ and } a - b \in Z\}$. (3)
Show that:
(i) $(a, a) \in R$ for all $a \in Q$
(ii) $(a, b) \in R$ implies that $(b, a) \in R$
(iii) $(a, b) \in R$ and $(b, c) \in R$ implies that $(a, c) \in R$

OR

(b) If A = $\{x : x^2 - 5x + 6 = 0\}$; $B = \{2, 4\}$, and $C = \{4, 5\}$, find the value of $A \times (B \cap C)$ and $(A \times B) \cup (C \times B)$.

31. (a) The sum of the first three terms of a G.P. is 16, and the sum of the next three terms is 128. Determine the first term, the common ratio and the sum to *n* terms of the G.P. (3)

OR

(b) The ratio of the A.M and G.M. of two positive numbers a and b, is $m : n$.
Show that: $a : b = \left(m + \sqrt{m^2 - n^2}\right) : \left(m - \sqrt{m^2 - n^2}\right)$.

SECTION- D

32. (a) Prove that $\frac{cos4x+cos3x+cos2x}{sin4x+sin3x+sin2x} = cot3x$. (5)

OR

(b) Sudhir, a student of class XI, got an assignment from his Maths teacher. He did all the questions except a few. If the value of $sin\ x$ = 3/5 and $cos\ y$ = −12/13 where x and y both lie in the second quadrant, then help Sudhir to solving these questions.
(i) What will be the value of $cos\ x$ and $sin\ y$?
(ii) Find the value of $sin(x + y)$ and $cos(x - y)$.

33. What is the number of ways of choosing four cards from a pack of 52 playing cards? In how many of these: (5)
(i) Four cards are of the same suit.
(ii) Four cards belong to four different suits.
(iii) All four cards are face cards.
(iv) Cards are of the same colour.

34. Find the sum of n terms of the series $0.6 + 0.66 + 0.666 + 0.6666 + \cdots$ (5)

35. (a) If P be the sum of odd terms and Q that of even terms in the expansion $(x + a)^n$. (5)
Prove that: (i) $P^2 - Q^2 = (x^2 - a^2)^n$
(ii) $4PQ = (x + a)^{2n} - (x - a)^{2n}$

OR

(b) If $z = \left(\frac{\sqrt{3}}{2} + \frac{i}{2}\right)^5 + \left(\frac{\sqrt{3}}{2} - \frac{i}{2}\right)^5$. Then using binomial theorem, show that $Im\ z = 0$.

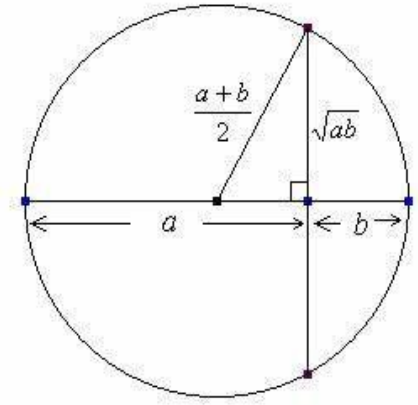
SECTION- E

36. Three friends were having get together. Suddenly they decided to play with their names using sets. Name of friends were AARTI, CHARVI and AYSHA. They asked each other the following questions
(i) Write the letters of name AARTI in the roster form. (1)
(ii) What is the difference of set of letters of CHARVI and AYSHA? (1)
(iii) (a) Form a union of sets, taking the letters of names of friends. (2)

OR

(b) Form a set of intersection of sets, taking the letters of names of friends.

37. Read the following passage and answer the questions given below.



- The A.M. of two numbers a and b is denoted by $\frac{a+b}{2}$.
- The G.M. of two positive numbers a and b is denoted by $\sqrt{ab}$.
- A.M. $\geq$ G.M. for any two positive real numbers.

(i) If $\frac{a^n + b^n}{a^{n-1} + b^{n-1}}$ is the A.M. between a and b, then find the value of n. (2)

(ii) If $\frac{a^{n+1} + b^{n+1}}{a^n + b^n}$ is the G.M. between a and b, then find the value of n. (2)

38. Republic day is a national holiday in India. It honours the date on which the constitution of India came into effect in the year 1950 replacing the Government of India Act (1935) as the governing document of India and thus, turning the nation into a newly formed republic.

Answer the following questions, which based on the word "REPUBLIC".

(i) Find the number of arrangements of the letters of the word "REPUBLIC". (1)
(ii) How many arrangements start with a vowel? (1)
(iii) (a) How many ways can the letters of the word 'REPUBLIC' be arranged if there are always 4 letters between E and C? (2)

OR

(b) If the number of arrangements of the letters of the word "REPUBLIC" is $\alpha\beta\gamma\delta\rho$, then find the value of $(\alpha + \beta + \gamma + \delta + \rho)$. Also find how many arrangements start with consonants?